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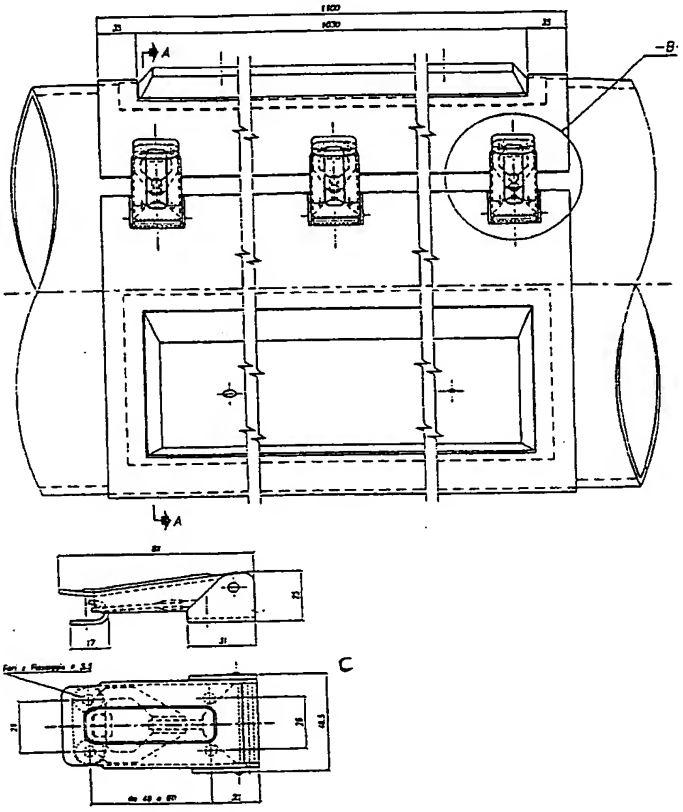
(54) Title: METHOD FOR CENTRALISING A TIGHT FITTING CASING IN A BOREHOLE



(57) Abstract: Method for the centralization of drill casings in a tight borehole, both vertical and deviated, comprising the following operations: Application on the casing section in question, of an adherence strip equipped with one or more housings and rapid adjustable lever closure; Insertion of suitable moulds in the housings of which the strip is equipped; Injection into the moulds of plastic material characterized by a high mechanical resistance, a high degree of surface adhesion and resistance to abrasion by friction, and also in-place elasticity, higher than the elasticity of the casings; Removal of the adherence strip once the hardening of the plastic material in the shape of the mould, has been completed.

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METHOD FOR CENTRALISING A TIGHT FITTING CASING IN A BOREHOLE

The present invention relates to a method for the centralization of drill casings to be used for lean profile applications, which substantially comprises the application of strips of ceramic material onto the outer walls of the casing.

During the drilling of oil wells, set casing operations of the hole are effected, which comprise the positioning of specific casings at pre-established intervals in relation to the depth reached and characteristics of the formations penetrated.

When effecting set casing, in order to guarantee an easy lowering of the casings into the well, it is generally necessary to ensure that the difference between the external casing diameter and the hole diameter (clearance) is maintained at sufficiently high values.

During drilling, according to conventional technologies, the clearance between casing and hole can vary from

values of about 6-7 inches (15-16 cm) for the surface and/or intermediate phases, up to values close to an inch for the deeper phases (for example: 26" hole for a 20" conductor pipe; 171/2" hole for a 133/8" casing; 121/4" hole for a 95/8" casing; 81/2" hole for a 7" casing).

The necessity of adopting high clearance values is linked to the high rigidity of pipes with a greater diameter/thickness and to the impossibility of drilling perfectly vertical holes and/or with controlled curvature. The poor flexibility, in fact, of the pipes together with a certain degree of irregularity of the hole (deviations, tortuosity and/or squeezing), can make the lowering of the casings into the well problematical, above all during the surface and/or intermediate phases.

The necessity, according to conventional technologies, of effecting holes with a much larger diameter with respect to that of the casing, to guarantee its lowering to the well bottom during the surface and intermediate phases, causes the formation of a considerable quantity of waste products and a lengthy stay time of the plant on the territory, with consequent long drilling times and high costs.

The Applicant is holder of the copending Italian patent application MI 2000A 000007 of 5.01.2000 which relates to an improved method for the drilling of oil wells and contemporaneous positioning of specific casings, character-

ized by maintaining the clearance more or less constant for the whole well depth desired, which consists in effecting the drilling of the well section of interest, maintaining a high degree of regularity of the hole by the use of automatic equipment for verticality and/or curvature control.

This drilling method allows, with the same diameter of the casing, the dimensions of the upper part of the well (surface and intermediate casings) to be reduced. This enables a substantial reduction in materials (sludge, cement and steel) and consequently in the production of waste products. This technique also avoids the necessity of producing holes with a diameter which is too high with respect to the casings to be positioned, which generally implies the possibility of effecting holes with a lower diameter with respect to the conventional technique. All of this has a positive influence on the advance rate of the chisel bit and therefore allows a reduction in the production times of the holes with a consequent decrease in costs. The technique according to said invention also enables significant savings to be obtained on the operating costs, as the verticality and/or regular curvature of the well facilitates all workover and well intervention operations.

This method comprises a drilling and set casing technique which allows the positioning of casings, operating with a clearance which is more or less constant at values

of about 1.5 inches (3-4 cm) for the whole well depth desired. The fact of operating with a reduced clearance allows, with the same number of casings and end-diameter of the casing, the dimensions of the upper part of the well to be significantly reduced.

This solution is particularly suitable for applications in deep, vertical or off-line wells, also in the presence of formations with a low drillability and/or difficulty in trajectory control. In these cases, on adopting the technique described, a considerable saving of time and drilling costs is obtained.

In the drilling method mentioned above, as generally in all lean profile applications, the centralization of the casings, when effected with traditional procedures, is highly critical.

This criticality is due to the lack of physical space necessary for the mechanical installation of centralization systems (reduced spaces corresponding to mechanical fragility).

As the inclination of the hole increases, so does the criticality due to the higher casing/hole wall interference, obviously greater in the hole sections with the presence of more or less severe doglegs.

The absence of centralization of the casing, however, has the following disadvantages:

- Increase in the friction factor, with an increase in the wear of the casing and consequent decrease in its resistance properties;
- Increase in the risks of the wedging of the casing with the risk of not succeeding in correctly lowering the casing to the bottom;
- Unbalance in the flow by-pass area;
- Reduction in the quality of cementations by the canalization of cement during displacement.

For conventional (standard) well profiles, these problems are drastically reduced by centralizing the casing.

The centralizing is, in fact, obtained by inserting along the outer surface of the casing, various elastic metallic blades (similar to leaf springs), with an extended diameter comparable to that of the hole, capable of keeping the casing at a distance from the wall and uniformly centred with respect to the hole axis:

This solution cannot however be applied in the case of lean profiles as:

- All standard centralizers existing on the market have a blade supporting body and a stop collar for attaching them to the pipe; this increases the overall bulk which excludes their application for systems with reduced diameter clearances;
- Centralizers for particular applications, such as for

example intracasing centralizers, drastically modify the total rigidity of the casing, which viceversa must be able to maintain a good elasticity (flexibility) for following the geometry of the hole to the utmost.

The Applicant has now found, according to the object of the present invention, that it is possible to overcome all the known drawbacks in the state of the art by effecting the centralization of drill casings by means of the application of strips of ceramic material on the outer walls of the casings.

The object of the present invention therefore relates to a method for the centralization of casings for applications of the lean profile type, both vertical and off-line, which comprises the following operations:

- Application on the casing section in question, of an adherence strip equipped with one or more housings and rapid adjustable lever closure;
- Insertion of suitable moulds in the housings of which the strip is equipped;
- Injection into the moulds of plastic material characterized by a high mechanical resistance, a high degree of surface adhesion and resistance to abrasion by friction, and also elasticity in place, higher than the elasticity of the casings;
- Removal of the adherence strip once the hardening of the

plastic material in the shape of the mould, has been completed.

An important advantage of the method described above is the possibility of its being effected directly on site, thus obtaining centralizers whose shape, dimension, number and position can be established a priori, in relation to the operating requirements. The position, length and thickness with which the centralizers are to be produced, can, in fact, be calculated and determined a priori, in relation to the diameter of the casing, the length and inclination angle of the hole section along which the casing is to be lowered.

Once the project characteristics have been defined, the pipes are blasted to obtain a surface capable of ensuring correct adhesion of the resin. At the end of the blasting phase, each pipe is equipped with a specific adhesion strip, obtained using a transparent plate made of plastic material with a high resistance (figure 1), having a rapid adjustable lever closure, capable of housing die cast moulds: figure 2 illustrates an example in which from a minimum of one to a maximum of three die cast moulds can be present.

Each mould has a specific injection hole, through which the resin compound, obtained by means of an appropriate mixing system between resin and hardener, is poured.

CLAIMS

1. A method for the centralization of drill casings for applications of the lean profile type, either vertical or off-line, comprising the following operations:

- Application on the casing section in question, of an adherence strip equipped with one or more housings and rapid adjustable lever closure;
- Insertion of suitable moulds in the housings of which the strip is equipped;
- Injection into the moulds of plastic material characterized by a high mechanical resistance, a high degree of surface adhesion and resistance to abrasion by friction, and also elasticity in place, higher than the elasticity of the casings;
- Removal of the adherence strip once the hardening of the plastic material in the shape of the mould, has been completed.

2. The method for the centralization of drill casings for lean profile applications according to the previous claim, wherein the adhesion strip contains a maximum of three housings.

3. The method for the centralization of drill casings for lean profile applications according to claim 1, wherein the plastic material injected into the moulds

is preferably an epoxy resin.

Fig.1

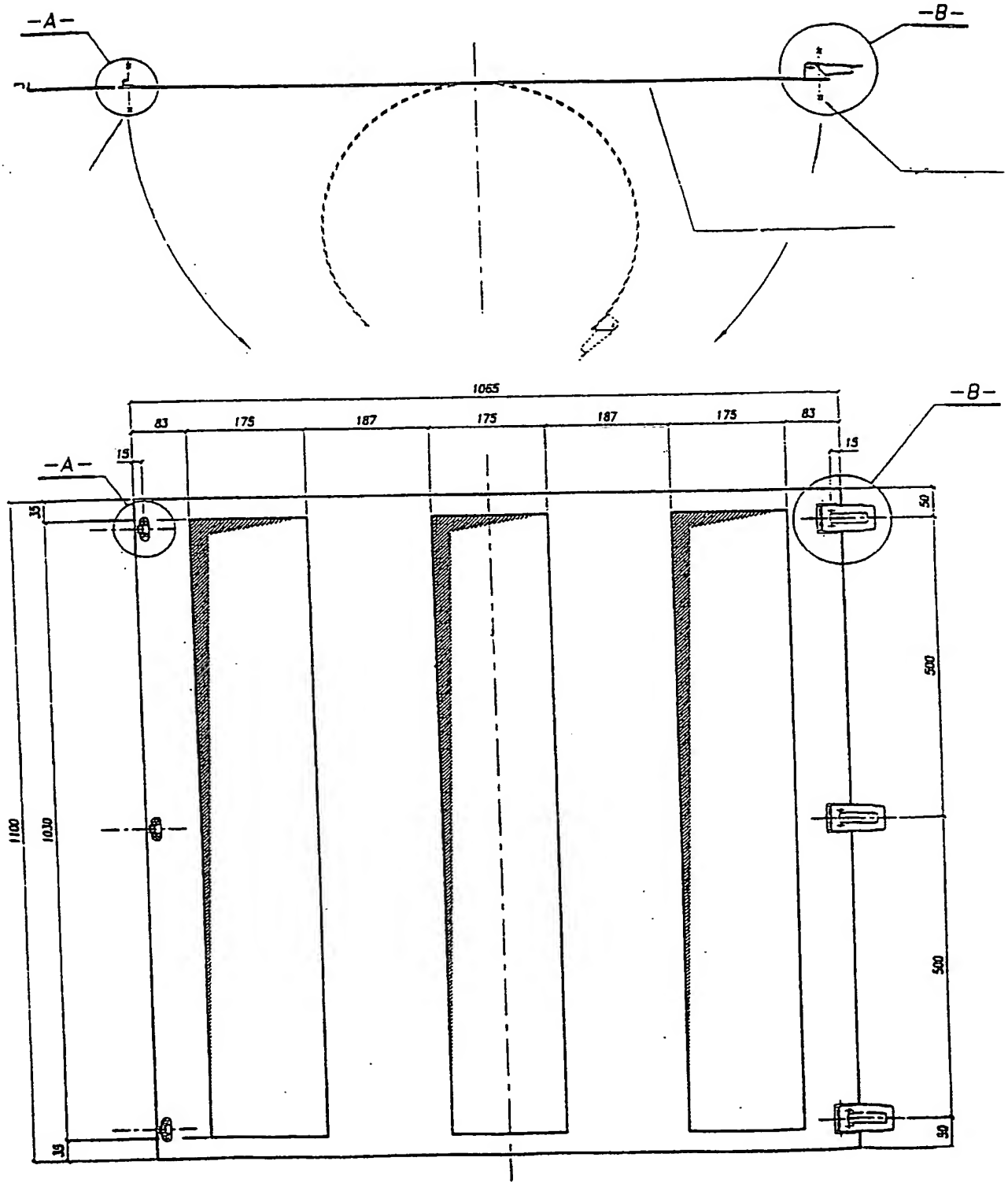
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Fig.2

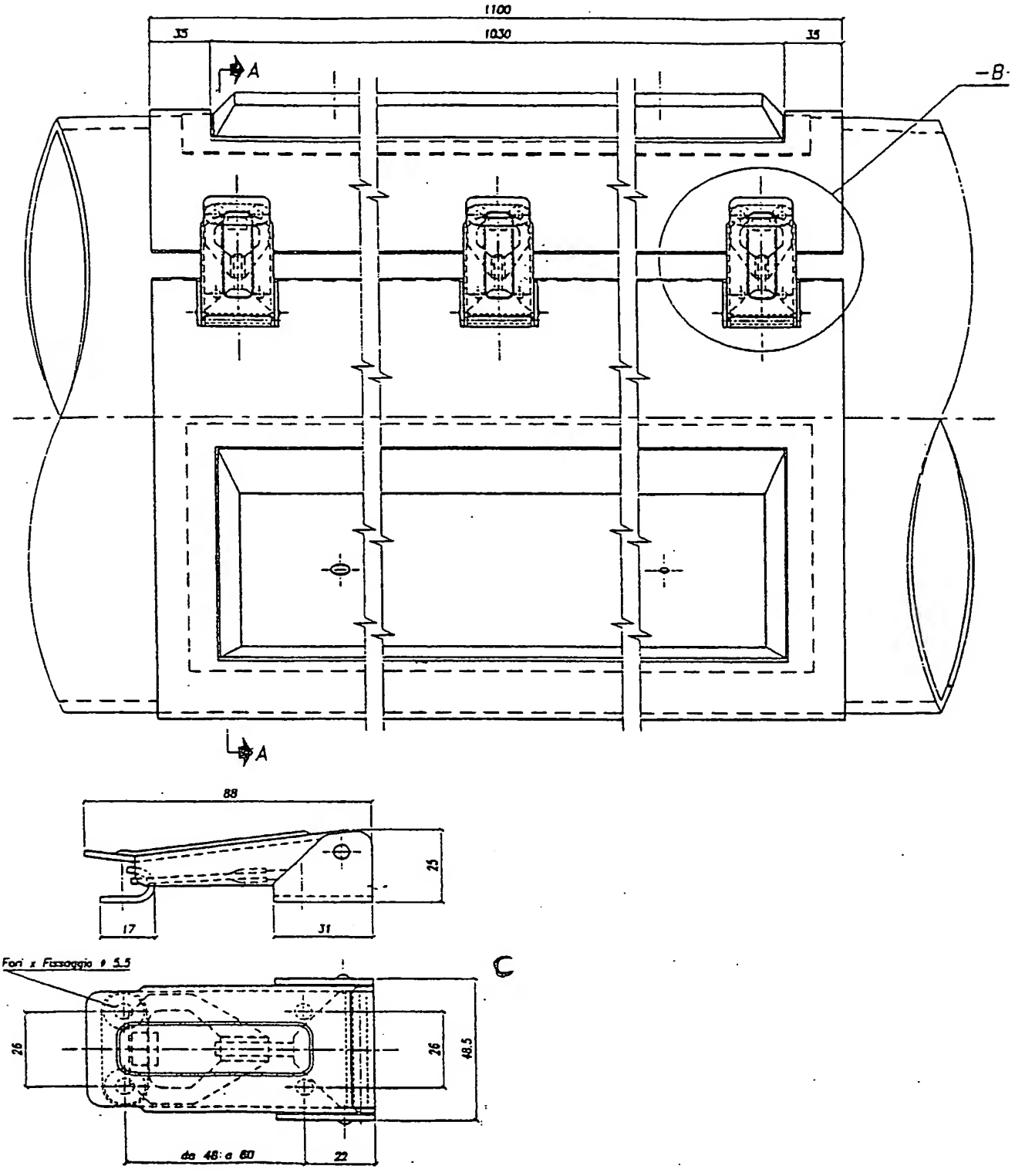
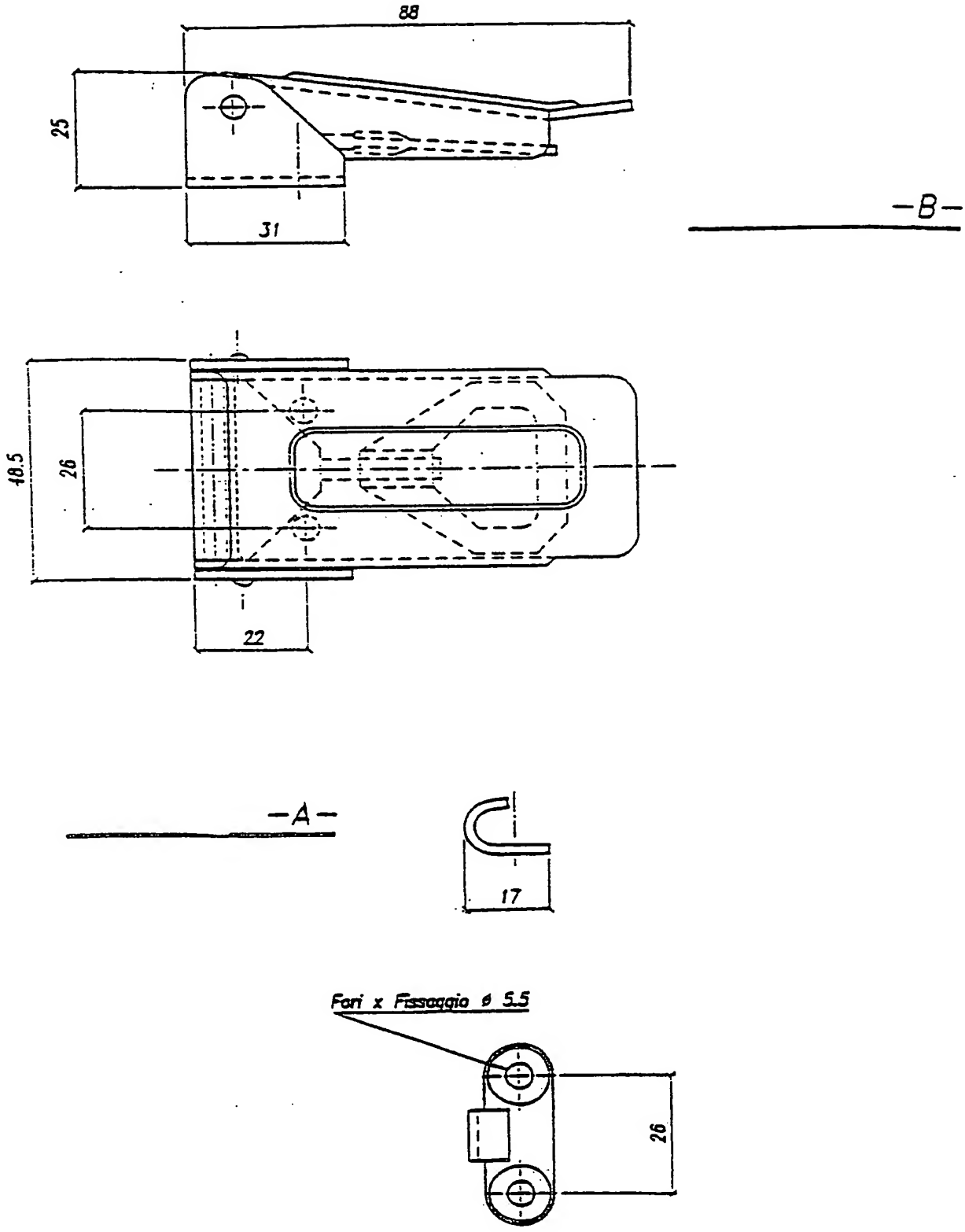


Fig.3



A. CLASSIFICATION OF SUBJECT MATTER
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According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 095 981 A (MIKOLAJCZYK RAYMOND F) 17 March 1992 (1992-03-17) column 1, line 11 - line 18 figure 1	1
A	US 3 948 575 A (ROSSER EUGENE P) 6 April 1976 (1976-04-06) column 3, line 38 -column 3, line 59; figure 3	1,3
A	US 2 286 716 A (CLARK ERNEST J) 16 June 1942 (1942-06-16) figures 2-6	1
A	US 5 613 556 A (SABLE DONALD E ET AL) 25 March 1997 (1997-03-25) , sentence 26 - sentences 301,4,4A	1

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
26 March 2002	19/04/2002

Name and mailing address of the ISA	Authorized officer
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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